

Update of Ω_c^0 lifetime measurement

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Ω_c^0 lifetime measurement meeting

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Outline

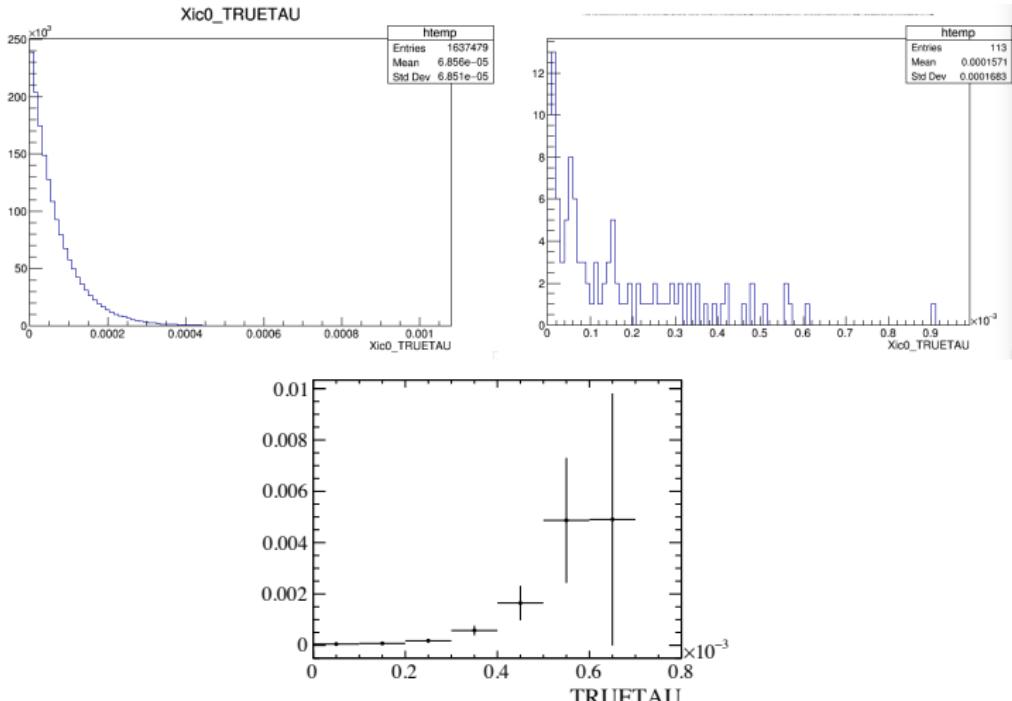
- Efficiency estimation of $\Omega_c^0 \rightarrow p K^- K^- \pi^+$
- Study of $D^{*+} \rightarrow D^0 (\rightarrow K^- K^+ \pi^- \pi^+) \pi^+$ control mode
 - Samples
 - Event selection
 - Prompt Yield extraction
- Next steps

Turbo selections of $\Omega_c^0 \rightarrow p K^- K^- \pi^+$

Items	Cuts
Daughter K	(TRCHI2DOF<3) (PT>500.) (P>1000.) (PIDK>10.) (MIPCHI2DV(PRIMARY) > 4.0)
Daughter π	(TRCHI2DOF<3) (PT>500.) (P>1000.) (PIDK<0.) (MIPCHI2DV(PRIMARY) > 4.0)
Daughter p	(TRCHI2DOF<3) (PT>500.) (P > 10000.) (PIDp > 10.0) & ((PIDp-PIDK) > 5.0) (MIPCHI2DV(PRIMARY) > 4.0)
CombinationCut	(in_range(2386.0, AM, 2780.0)) ((APT1+APT2+APT3+APT4) > 3000.0) (AHASCHILD(PT > 1000.0)) (ANUM(PT > 500.0) >= 2) (AHASCHILD((MIPCHI2DV(PRIMARY)) > 8.0)) (ANUM(MIPCHI2DV(PRIMARY) > 6.0) >= 2)
MotherCut	(VFASPF(VCHI2PDOF) < 10.0) (BPVDIRA > cos(0.01)) (BPVLTIME() > 0.0001) (BPVVDCHI2 > 10.0)

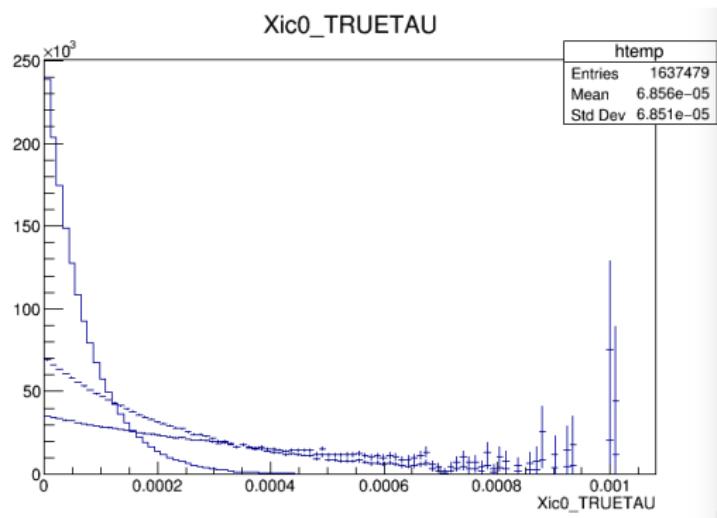
TRUETAU distributions

- Before reconstruction (left) and passing turbo line (right)
- Efficiency acceptance (bottom)



Re-weight τ distribution

- Re-weight $\tau = 69 \text{ fs}$ to 250 fs and 500 fs
- An conservative estimation: suppose efficiency in decay time bin larger than 0.6 ps the same as 0.6 ps , and request 20M generated events with exponential TRUETAU distribution
 - $\tau = 69 \text{ fs}$: 1374; 500 fs : 40442; 1000 fs : 62430



Samples of $D^{*+} \rightarrow D^0(\rightarrow K^-K^+\pi^-\pi^+)\pi^+$ mode

- Data sample

- 2016 Collision data collected with
Hlt2CharmHadDstp2D0Pip_D02KmKpPimPipTurbo

- 2016 MC sample

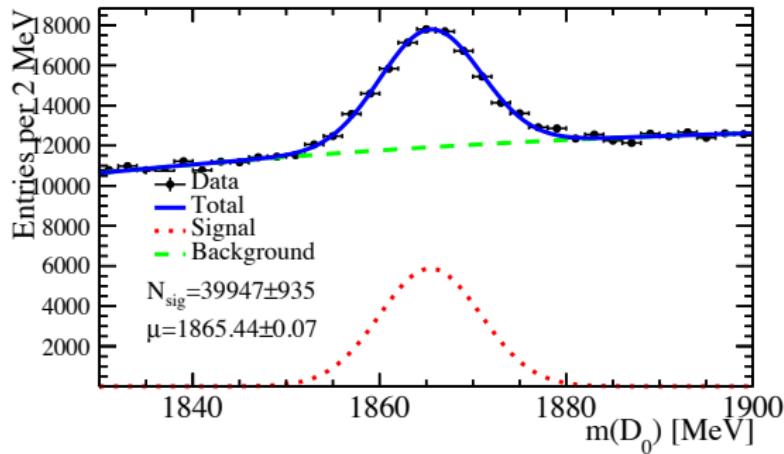
- EventType: 27165003
 - Identify prompt contribution with D^{*+} MOTHER ID

Turbo selection

DaughtersCuts	TRCHI2DOF < 3.0 PT > 250.0 P > 1000.0 MIPCHI2DV(PRIMARY) > 3.0
K	PIDK > 5
π	PIDK < 5
CombinationCuts	(APT1+APT2+APT3+APT4) > 1800.0 AP > 25000.0 ADDOCA(i,4) < 100.0, i=1,2,3 ACHI2DOCA(i,4) < 10.0, i=1,2,3
MotherCuts	CHI2VXNDOF < 12.0 PT > 2000.0 P > 30000.0 BPVDIRA > cos(0.02) BPVLTIME() > 0.0001 BPVVDCHI2 > 25

Total yield

- A small fraction of 2016 data
- Further offline cuts: $K \text{ PIDK} > 10$ and $\pi \text{ PIDK} < 0$



$\log \chi^2_{IP}$ modelling

- Bukin function, a modified Novosibirsk function with extended tail parameters

$$\mathcal{P}(x; \mu, \sigma, \xi, \rho_1, \rho_2) = \begin{cases} \exp \left\{ \frac{(x-x_1)\xi \sqrt{\xi^2+1}\sqrt{2\ln 2}}{\sigma \left(\sqrt{\xi^2+1}-\xi \right)^2 \ln \left(\sqrt{\xi^2+1}+\xi \right)} + \rho_1 \left(\frac{x-x_1}{\mu-x_1} \right)^2 - \ln 2 \right\} & x \leq x_1, \\ \exp \left\{ -\ln 2 \left[\frac{\ln \left(1+2\xi \sqrt{\xi^2+1} \frac{x-\mu}{\sigma \sqrt{2\ln 2}} \right)}{\ln \left(1+2\xi^2-2\xi \sqrt{\xi^2+1} \right)} \right]^2 \right\} & x_1 < x < x_2, \\ \exp \left\{ \frac{(x-x_2)\xi \sqrt{\xi^2+1}\sqrt{2\ln 2}}{\sigma \left(\sqrt{\xi^2+1}-\xi \right)^2 \ln \left(\sqrt{\xi^2+1}+\xi \right)} + \rho_2 \left(\frac{x-x_2}{\mu-x_2} \right)^2 - \ln 2 \right\} & x \geq x_2. \end{cases}$$

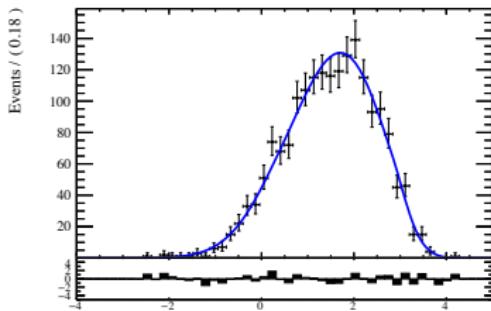
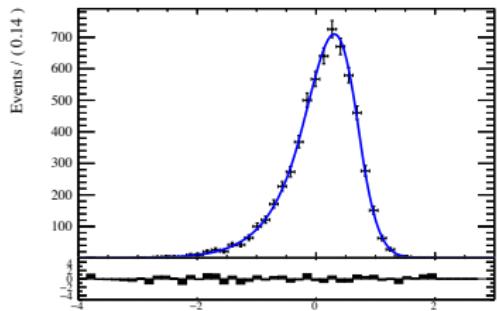
where

$$x_1 = \mu + \sigma \sqrt{2 \ln 2} \left(\frac{\xi}{\sqrt{\xi^2+1}} - 1 \right)$$

$$x_2 = \mu + \sigma \sqrt{2 \ln 2} \left(\frac{\xi}{\sqrt{\xi^2+1}} + 1 \right)$$

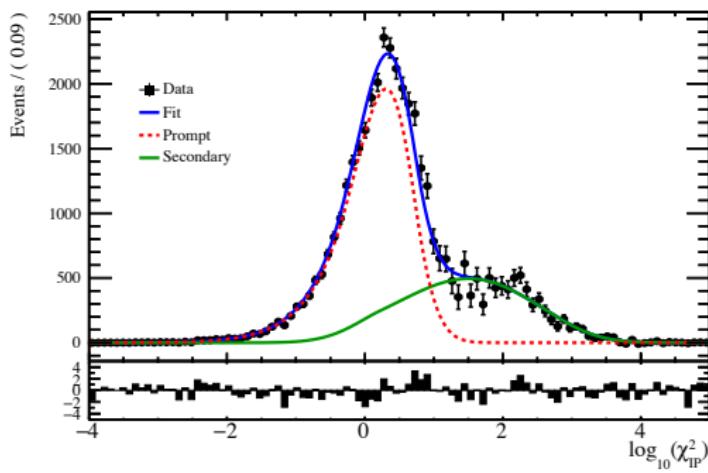
Fit to IPCHI2 of MC sample

- Prompt component (left)
- Secondary component (right)



Fit to IPCHI2 of data sample

- Fit to sWeighted data
- Fixed parameters: prompt parameters
- ERR MATRIX NOT POS-DEF



EXT. NO.	PARAMETER NAME	VALUE	APPROXIMATE ERROR
1	ap_b	1.50435e+00	2.75428e-01
2	nfromb	1.33866e+04	7.54033e+01
3	nprompt	2.65241e+04	1.37416e+02
4	rho1_b	-2.32100e+00	6.55026e-04
5	rho2_b	-1.52655e+00	9.41098e-02
6	sigp_b	1.02730e+00	1.50190e-03
7	xi_b	-5.93833e-02	7.73500e-03

Next to-do

- Test the fit stability
- Try to fit in decay time bins